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ABSTRACT

This study examined the variation in children's choice of learning centers in a naturalistic, free-play setting. The study was designed to develop a realistic picture of how 4- and 5-year-olds interact in each of 4 settings (computer, dramatic play, block, and manipulative) to allow for comparison of their behaviors between genders and across settings. Children from two classrooms at a university preschool program made up the sample. Children were videotaped without their knowledge, and their social interactions were defined as disruptive, unoccupied, teacher interaction-child initiated, teacher interaction-teacher initiated, onlooker, solitary, parallel, or cooperative. Findings showed almost no disruptive behavior in any of the centers; the highest amount of conflict was coded in the block area, which also contained the highest amount of cooperative behavior. While the ratio of time spent in a center by gender was 3:4 minutes for the dramatic play, block, and manipulative centers (3 for boys and 4 for girls), the ratio in the computer center was 5.3:2.2 (5.3 for boys and 2.2 for girls). Although the software was screened for gender bias and the computer to child ratio was 2:21, boys spent 2 to 3 times more time than girls at the computer center. Girls engaged in a higher percentage of cooperative play than boys in the computer, dramatic, and manipulative centers. Findings suggested that modifications to computer centers may need to include opportunities for cooperation among children as well as software that includes female characters and themes. (Contains 20 references.) (EV)

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Comparison of the Types of Cooperative Problem Solving Behaviors in Four Learning Centers: Computer, Dramatic Play, Block, and Manipulative

by Genan T. Anderson

ABSTRACT: This investigation utilized the naturally occurring behaviors and choice of centers by four- and five-year-old children video taped without their knowledge. It examined the social interaction (defined as disruptive, unoccupied, teacher interaction—child initiated, teacher interaction—teacher initiated, onlooker, solitary, parallel, and cooperative) of children in four centers—block, dramatic play, manipulative, and computer. Two classrooms of children from a university preschool program made up the sample. There were 42, predominantly white, middle-class, children (20 boys and 22 girls) mean age of 56 months. Each center was taped for 30 minutes once a week for four weeks. Social behaviors of each child were coded in 10-second intervals for every 10-seconds the child was in the video taped centers (Kappa = 0.9). The range of variation in parallel behavior was 17 percent with computers the high and blocks the low. When the computer center (high percentage in parallel play; low value in cooperative play) was compared to blocks (low value in parallel play; high value in cooperative play), there was a 19 percent difference in the amount of time spent in cooperative interaction. After the three hierarchy social behaviors—onlooker, parallel, and cooperative—were combined, there remained almost no difference between the centers although variations remained between gender. We saw the area of greatest variation in magnitude in the interaction between gender and center; most markedly in the computer center. While the ratio of time spent in each center is 3:4 for dramatic play, block, and manipulative centers (3 being boys and 4 being girls), the ratio in the computer center is 5.3:2.2 (5.3 being boys and 2.2 being girls).

Introduction and Review of Literature

The "widely held expectations" for the interactional style of four-year-olds is that they play and share with others but also begin true give-and-take, cooperative play (Bredekamp & Copple, 1997 and Rubin, et al., in press). This overarching statement is derived from the quantitative and qualitative observations of those who study and work with young children. In their review of research on children's peer interactions Rubin, et al. (in press) reported that 5-year-olds "…spend less of their free play time in classroom settings interacting with others than being alone or near others" (p. 19). They contend that watching and playing near but not with others may be the sequences the young child uses to gain entry into an ongoing play activity.

Examining the variations in play and interactional styles of the four- to five-year-old by gender broadens our perspective and understanding of their behaviors. Macoby (1990) characterizes the play of girls by their use of enabling styles; i.e., acknowledge other's comment, express agreement, support

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what partner is doing. Their conversation is a socially binding process, and they are generally averse to rough-and-tumble play style characteristic of boys. On the other hand, boys are orientated toward issues of competition and dominance and are not easily influenced by girls. She observed that boys get more than their share of access to scarce resources. They use speech to protect turf and employ more constricting styles; i.e., behaviors that cause the partner to withdraw.

In sharp contrast, Thouvenelle, et al. (1994) contends the preferences of materials and activities by boys or girls appear to be shaped by social conventions and expectations, which are transmitted by peers, parents, older siblings, teachers, television, and the mass media rather than by innate, genetic determinants.

Petrakos & Howe (1996) found that solitary-designed centers facilitated more solitary play while group-designed centers facilitated more group play. When observing social interaction across settings they found that the children's behavior varied more across settings than within settings. In comparing housekeeping, sand, manipulative, vehicle, and reading settings, they found the highest proportion of complex social interactions occurred in the housekeeping setting. They also noted that time to interact was necessary to provide opportunity for the cooperative group play. Their results confirmed that the physical arrangement of setting directly influence type of play.

When preschools add computers as a center choice, the children's preference for this center parallels that of other more traditional centers (Haugland & Wright, 1997, and Shade & Watson, 1990). Computers can be a very social activity (Davidson, 1990). Young children engage in high levels of spoken communication, social interaction, and cooperation at computer. They generally prefer working with a partner, share leadership roles, negotiate turns, resolve differences of opinion regarding the direction the game should take, seek help from peers, initiate interaction, and take turns (Clements,

1994, Clements, 1993, Clements, 1987 and Davidson, 1990). Shade (1990) contends that the shy children seem to emerge at computers and Clements (1987) concludes that "preschoolers' social interactions may be no different in computer learning centers from those in other centers such as blocks or art"(p. 6).

The question of gender equity and open-choice computer selection is fraught with controversy. While Bergin (1993) contends there is almost no gender difference in social behavior patterns at the computer, she studied children assigned to computer use in pairs one hour per week per child rather than an open-choice setting. King & Alloway (1992), on the other hand, concluded that unmonitored free-play allows for inequity of use at computers. Although there were three computers for 18 children in his study, there was only one chair placed near each computer. In this setting, the boys were more dominant in securing a turn, using the computers 60% of the time. Clements (1987) review of the literature on young children's computer use concluded that "boys younger than five used the computer more than did girls the same age"(p. 35) when the ratio was one computer for every 22 children and no teacher intervention. Thouvenelle, et al, (1994) also found boys competitive in their use of computers. The disparity between the masculine competitive, aggressive play and the girls general lack of interested in competition led him to posit that the play style of boys at computers intimidated the more reticent girls. He felt the atmosphere at computers prevented girls from approaching or exploring computers. He added the possibility that the bias stemmed from the software. In contrast, Clements (1987) concluded that the majority of research reports indicated that girls and boys did not differ in amount or type of computer use when the computer to child ratio was one computer for every 12 children. In fact, at this ratio the sex difference favored the girls.

The model of Petrakos & Howe (1996) employed contrived settings to observe a specific number of children for a predetermined amount of time. Other researchers (Pepler & Craig, 1995, Asher & Gabriel, 1993, McNeilly-Choque, et al. 1996.) found observing the interactions of children in a naturalistic setting more representative of the spontaneous exchanges between children. Each of these researchers studied children outdoors on playgrounds.

There is a broad precedence in using video taping to study the social interactions of children. This method has been employed with both contrived and naturalistic research models. Asher (1993), Hart, et al. (1995), and Pepler & Craig (1995) all used video taping to record playground interactions of children. Shade (1994), Petrokos & Howe (1996), Bergin, et al. (1993) and Rhee (1991) utilized hidden cameras to record children in classroom settings. Transcription of the data on the tapes varied from recording a running log (Asher, 1993, Pepler, 1995) to coding behaviors in 10 or 15 second intervals (Hart & Sheehan, 1986, Bergin, et al., 1993, Coplen & Rubin, 1994, and Petrakos & Howe, 1996).

This study will examine the variation in children's choice of learning centers in a naturalistic, free-play setting. Open-choice of centers and playmates and time to interact should paint a realistic picture of how four- and five-year-olds interact in each of four settings. A quantitative coding of social interaction will make a comparison of those behaviors between gender and across settings.

In our examination of the play behaviors of preschool children we hoped to answer several questions: Will disruptive behaviors occur more frequently in one or two of the centers than in the other centers? How balanced will be their choices of centers? In an open-choice environment will we see a variation in the gender selection across centers? Will there be centers that require more supervision than others?

Sample:

Forty-two middle-class children attending two classrooms in the same university preschool were studied. There were 20 boys and 22 girls (*M* age = 56 months, range = 46 to 62 months). The children are predominantly white from middle-income, two-parent families with the mother at home as a full-time homemaker. Thirty-two of the children have computers in their homes (18 boys, 14 girls). Twenty-eight (18 boys, 10 girls) families reported having software specifically for the child and the mean time these children spend using a computer at home was 2.3 minutes per week (3.3 boys, 1.3 girls) with a range of 0 to 12 (0 to 12 boys, 0 to 7 girls).

Procedure:

The teachers in the classrooms share the same teaching philosophies and were willing to coordinate scheduling so that all the children could be videotaped at the same time each day. The videotaping began two weeks after the children started preschool so the children were equally familiar with their classmates and the equipment and schedule in the preschools. The arrangement and content of each of the four centers—computer, manipulative, block, and dramatic play—were controlled to be as similar as possible in each of the two rooms (allowing for differences in the size and shape of the rooms). Dramatic play was equipped with basic housekeeping furniture and props. The block center had large, pocket blocks, smaller unit blocks with basic curved pieces, and wooden trucks and cars. The manipulative center had wooden puzzles, floor puzzles, Legos, beads, buttons, pattern blocks, lacing cards, peg boards, bristle blocks, and other similar materials. The computer center had two computers with three chairs per computer. The same two software programs were used, *Mixed Up Mother Goose Deluxe* and *Millie's Math House*. These programs were selected for their developmentally appropriateness and gender equity (Haugland and Wright (1997). No time limit for use of equipment

was dictated for any of the centers. Every attempt was made to maintain the naturalistic opportunity for the children to choose where to spend their free-play time.

The videotaping began fifteen minutes after the beginning of the day (8:45—9:15 A.M.) to allow for the majority of the children to be present. The preschool day in these classrooms began with a free-play period. The choice of activities available to the children included blocks, manipulatives, dramatic play, computers, reading, writing and art. The teachers was aware of which center was being videotaped each day; but, because the cameras were mounted in the classroom and the recorder is in a separate room, the children were unaware of the videotaping. Each center was taped four times for thirty minutes per session in an effort to obtain a representative sampling of the children who choose to play in them as well as a representative frequency and duration. One center was taped each day (four days per week) for four weeks with a random assignment of the day of the week each was taped. This yielded four tapings of each center on four different days of the week over a four-week time span.

Method:

Eight undergraduate students were trained to code the social interaction of the children in 10-second intervals (Nastasi & Clements, 1993). They watched one child through the four segments of each of the four centers, pausing the tape every ten seconds to record the predominant social interaction occurring during that interval.

Behaviors in seven categories (disruptive, unoccupied, teacher orientation-–child initiated, teacher orientation—teacher initiated, onlooker, solitary, parallel, and cooperative) were observed. The code sheet of definitions subdivided each category into at least two to four sub-categories with another two to four specific behaviors defining those sub-categories. Each student was given two hours of training including practice coding using a video tape of the four centers. (The children in the training tape were not the same as those in the actual sample.)

A graduate student worked with the undergraduates and separately coded 15 percent of the 10-second codes to calculate the inter-rater reliability. Kappa was greater than 0.9.

Results

As seen in Tables 1 through 4, the range of variation in onlooker behavior is only 6 per cent with blocks being low and computers being high. This is a minimal deviation in frequency. A spread in percentage increased with parallel play with a difference of 17 percent with computers the high and blocks the low. There was also a difference of 14 percent from the low in block center to manipulative center. The change between computers (high) and dramatic play (low) was 8 percent with the difference between blocks (low) and dramatic play (high) was 9 percent. This variation in the percentage of time children play parallel with their peers is wider indicating a greater divergence between settings. The greatest spread in percentage of time children engage in one pattern of interaction occurred with cooperative interaction. While the computer center was the high percentage in parallel play, they became the low value in cooperative play. Compared to blocks (that was the low value in parallel play and the high value in cooperative play), there was a 19 percent divergence between the two centers. An 11 percent change from computer center (low) to dramatic play (high) remained moderate while the 7 percent difference between computer center (low) and manipulative center (high) and 5 percent variance between dramatic play (high) and manipulative center (low) dropped to minimal.

The similarity of overall play styles between the four centers is evident when we look at the three hierarchy social behaviors—onlooker, parallel, and cooperative (Rubin et al., in press). While variations remain between gender, the overall patterns are very close. The differences between gender are minimal to moderate with an interesting reversal in the traditional stereotype between the block center and dramatic play center (boys higher in dramatic play; girls higher in blocks).

In reviewing Table 5, we see the area of greatest variation in magnitude lies in the interaction between gender and center; most markedly in the computer center. While the ratio of time spent in each center is 3:4 minutes for dramatic play, block center, manipulative center (3 being boys and 4 being girls), the ratio in the computer center is 5.3:2.2 minutes (5.3 being boys and 2.2 being girls). Referencing the sample statistics, the amount of time spent using the computer at home for this sample was 3.3:1.3 minutes (3.3 being boys and 1.3 being girls). Even in a setting where the software is screened for gender bias and the computer to child ratio is 2:21, boys spend 2 to 3 times more time at a computer center than do girls.

Discussion, Application, and Implication for Further Research

This research measured the spontaneous exchange and interaction (or lack thereof) between four- and five-year-old children over four centers—dramatic play, block center, manipulative center, and computer center. The use of video taping the children in their regular free-play activities provided a naturalistic observation heretofore used primarily outdoors on playgrounds. The number of minutes children were coded (see Table 6) in each center were similar (M = 768, range 730 to 827) making comparisons with this method possible.

Our first question was whether disruptive behavior would occur more frequently in any one of the centers. If computers were seen by the children as scarce resources (or the farm animals, or Legos, or telephone) more competition and possible discord would be expected (Hartup & Laursen, 1995). Apparently, the ability to make another choice of center, the time available to engage in cooperative play, the availability of a teacher as mediator, or some other factor operated to minimize the amount of competitive, disruptive behavior that occurred in our sixteen hours of observation. Almost no disruptive behaviors were coded in any of the centers. The highest amount, 1 percent, was recorded in the block center where there was also the highest amount of cooperative behavior, 36 percent. Complex cooperation requires compromise that sometimes emerges from conflict.

Our second question examined the balance in the choice of center the children would make. In an open-choice environment would we see a variation in the gender selection across centers? While the controversy raged regarding the gender equity in computers, we were not prepared for the disparity of time spent in the computer center between boys (high) and girls (low). The pattern in the other three centers was very consistent except that we expected boys to spend more time in block play than girls. The more competitive nature of boys and the tendency of girls to be intimidated by the more dominant boys could explain the difference (Maccoby, 1990, Bergin, 1993, and King, 1992). Maybe our

careful attention to design of the center to control for gender equity failed (Petrakos & Howe, 1996). Perhaps the answer lies in the home socialization and the comparative differences in time spent with computers at home and at school for boys and girls—5 to 2 at school and 3 to 1 at home, boys high in both settings (Thouvenelle, et al., 1994). Girls engaged in a higher percentage of cooperative play than boys in the computer center, dramatic play, and manipulative center. The highest overall percentage of time in computers was spent in parallel play. It may be that girls do not find the opportunity for complex social interactions in a computer center as readily as in the other three centers. It may be their preference for interpersonal exchange draws them to the centers designed more naturally to facilitate these interactions (Petrakos & Howe, 1996, and Maccoby, 1990). Does computer software favor the mathematical, cognitive thinker, over the more verbal, linguistic thinker? These are questions yet to be explored.

In looking at the amount of time children interacted with the teachers, we found almost no variation in the centers when we measured behaviors where the child sought attention from the teacher. Greater variation occurred between centers in the amount of facilitating behaviors from the teachers. Still, the variation from the block center (high) to the dramatic play center (low) was minimal (4 percent). All of the centers generated about the same amount of independence and opportunity for facilitating learning.

As Clements (1987) suggested, the computer center can be an interactive as other centers. Teachers need to examine the arrangement and content of each center to facilitate their being used by the children for social interaction. Modifications to the computer center should include considerations to software that not only include female characters and themes, but software that is free of competition and offers opportunities for cooperation and interaction among multiple children. Greater attention may be required in sharing information regarding appropriate software for young girls with parents to encourage

an increase in the experience girls receive interacting with computers in their homes. Directed opportunities for girls to gain experience with computers need to be considered to facilitate the probability that they will choose to interact more frequently in a computer center. Additionally, further research comparing the social interaction style of the child (separate from gender) and their choice of center might add an important key to the free-choice selection of centers of four- and five-year-olds.

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Table 1. Percentage of time children spent in each type of play in the **Dramatic Play Center**

	Totals	Boys	Girls
Disruptive	0%	0%	0%
Unoccupied	3%	4%	1%
Child initiating teacher attention	5%	5%	5%
Teacher initiating interaction	9%	6%	11%
Onlooker	11%	10%	12%
Solitary	5 %	3%	7%
Parallel	39%	40%	39%
Cooperative	28%	32%	25%

Table 2. Percentage of time children spent in each type of play in the **Manipulative Center**

	Totals	Boys	Girls
Disruptive	0%	0%	0%
Unoccupied	1%	2%	1%
Child initiating teacher attention	6%	7%	5%
Teacher initiating interaction	13%	15%	11%
Onlooker	11%	10%	12%
Solitary	1%	1%	2%
Parallel	44%	44%	43%
Cooperative	23%	21%	25%

Table 3. Percentage of time children spent in each type of play in the **Blocks Center**

	Totals	Boys	Girls
Disruptive	0%	1%	0%
Unoccupied	2%	2%	2%
Child initiating teacher attention	5%	5%	5%
Teacher initiating interaction	13%	15%	11%
Onlooker	9%	9%	9%
Solitary	5%	6%	4%
Parallel	30%	36%	23%
Cooperative	36%	25%	46%

Table 4. Percentage of time children spent in each type of play in the **Computer Center**

	Totals	Boys	Girls
Disruptive	0%	0%	0%
Unoccupied	2%	1%	1%
Child initiating teacher attention	5%	5%	5%
Teacher initiating interaction	12%	10%	15%
Onlooker	15%	15%	15%
Solitary	2%	3%	1%
Parallel	47%	52%	43%
Cooperative	17%	14%	20%

Table 5. Total Scans in Minutes

	Total	Boys	Girls
Dramatic Play	827	344	478
Manipulative	749	324	425
Block	730	307	406
Computer	765	534	215